REMARKS

I. Introduction

In response to the Office Action dated November 10, 2004, claims 1 and 16 have been amended. Claims 1-30 remain in the application. Re-examination and re-consideration of the application, as amended, is requested.

II. Examiner Interview

Applicants' attorney, Bradley K. Lortz, interviewed Examiner Raymond on November 19, 2004 to clarify which U.S. Patent by Challoner et al. is applied in the Office Action rejections. Examiner Raymond confirmed that U.S. Patent 6,360,601 by Challoner et al. is the cited reference and the claims' status (rejected or objected to) is correctly identified in the Office Action Summary rather than the first sentence of paragraph (2) of the Office Action.

III. Amendments

Applicants' attorney has made amendments to claims 1 and 16 as indicated above. These amendments were made solely for the purpose of clarifying the language of the claims, and were not required for purposes of patentability. Particularly claims 1 and 16 recite that the digital drive controller circuit, the digital rebalance controller circuit and the digital demodulator comprise a distributed digital control circuit as previously recited in the preamble of claim 1. For additional support, see paragraph [0010] of the application as filed. No new matter is involved.

In addition, Applicants have amended the specification to clarify the Statement of Government Rights in paragraph [0003].

IV. Allowable Subject Matter

In paragraph (4), the Office Action indicates that claims 5, 8, 11, 13-15, 20, 23, 26 and 28-30 (list from the Office Action Summary – see Examiner Interview, above), are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In response, Applicants thank the Examiner for the indication of allowable claims. However, Applicants respectfully traverse the rejection of the remaining claims for the reasons set out below.

V. Cited Reference and the Present Invention

A. The '601 Patent

U.S. Patent 6,360,601, issued March 26, 2002 to Challoner et al. (hereafter "the '601 Patent"), discloses a micro-gyroscope having closed loop operation by a control voltage (V_{TY}), that is demodulated by an output signal of the sense electrodes, providing Coriolis torque rebalance to prevent displacement of the micro-gyroscope on the output axis (y-axis). The present invention provides wide-band, closed-loop operation for a micro-gyroscope and allows the drive frequency to be closely tuned to a high Q sense axis resonance. A differential sense signal is compensated and fed back by differentially changing the voltage on the drive electrodes to rebalance Coriolis torque. The feedback signal is demodulated in phase with the drive axis signal ($K_\omega\Theta_x$) to produce a measure of the Coriolis force.

B. The Present Invention

The present invention discloses embodiments that generally encompass a digital, application specific integrated circuit (ASIC) has been designed to perform excitation of a selected mode within a vibratory rate gyroscope, damping, or "force-rebalance," of other modes within the sensor, and signal demodulation of the in-phase and quadrature components of the signal containing the angular rate information. The ASIC filters dedicated to each channel may be individually programmed to accommodate different rate sensor designs/technology or variations within the same class of sensors. The ASIC architecture employs a low-power design, making the ASIC, particularly suitable for use in power-sensitive applications.

VI. Office Action Prior Art Rejections

In paragraphs (1)-(2), the Office Action rejected claims 1-4, 6, 7, 9, 10, 12, 16-19, 21, 22, 24, 25 and 27 under 35 U.S.C. §102(b) as being anticipated by the '601 Patent.

Applicants respectfully traverse these rejections for the reasons set out below.

The independent claims of the present invention a circuit device and method implemented with digital processing in a distributed digital control circuit. For example, claim 1 recites a circuit device comprising a digital drive controller circuit for producing a drive signal for exciting a drive mode of a vibratory gyroscope to a substantially constant amplitude from a drive mode response signal, a digital rebalance controller circuit for producing a sense rebalance signal from a sense mode response signal to regulate a sense mode of the vibratory gyroscope to substantially zero and a digital demodulator for demodulating the sense rebalance signal with the

drive mode response signal to produce a digital rate estimate of the vibratory gyroscope, wherein the digital drive controller circuit, digital rebalance controller circuit and digital demodulator comprise a distributed digital control circuit.

Paragraph [0005] of the application as filed describes the teaching of the '601 Patent. "A second feedback loop, as described by Challoner, et. al US6,360,601 can be used to regulate the response of the second mode to zero and in this case the feedback signal contains information on the angular rotation rate that may be calculated by demodulating this signal with the driven mode's response." Paragraph [0006] of the application as filed further discusses the deficiencies of a conventional approach implementing gyroscope control circuits, i.e. without a distributed digital control circuit of the present invention.

> The disadvantage of a discrete analog implementation is its inflexibility with regard to modifying component values for the purpose of "tuning" or customizing the control loops for a given sensor. Since mass-produced sensors will have some degree of variability amongst a batch of supposedly identical devices, this inflexibility represents a significant drawback. On the other hand, one disadvantage of using a general purpose digital signal processing chip is that general purpose centralized DSPs do not lend themselves to applications in which low power consumption is necessary (e.g., spacecraft, mobile systems, etc.). (para. 6, application as filed)

The distributed digital control circuit of the claimed invention overcomes these various disadvantages. However, the '601 Patent does not teach or suggest the claimed invention. Particularly, nowhere does the '601 Patent teach or suggest digital processing of any type and neither does the '601 Patent teach or suggest a distributed digital control circuit.

The Office Action asserts that the '601 Patent teaches a distributed digital control circuit device comprising a digital drive controller circuit for producing a drive signal for exciting a drive mode of a vibratory gyroscope to a substantially constant amplitude from a drive mode response signal shown in FIG. 2, drive controllers D1 and D1. However, FIG. 2 of the '601 Patent is a block diagram of a closed loop microgyroscope including a closed loop control circuit. See col. 3, lines 33-34 and 63-64. The '601 Patent does not mention any digital drive controller circuit as presently claimed. Furthermore, the '601 Patent specifies D1 and D2 are "drive electrodes", not "drive controllers" as asserted by the Office Action. In fact, the '601 Patent does not teach or suggest digital circuitry of any type in implementing a gyroscope control circuit. Accordingly, the '601 Patent cannot be read to teach both digital circuit components as well as a distributed digital circuit architecture.

The Office Action also asserts that the '601 Patent teaches a digital rebalance controller circuit for producing a sense rebalance signal from a sense mode response signal at column 4, lines 25-29. However, the '601 Patent specifically teaches:

> The control voltage V_{Tx} provides for automatic gain control of the drive amplitude. The control voltage V_{Ty} provides for Coriolis torque re-balance. The output axis (y-axis) gain and phase compensation are selected based on computed or measured transfer functions, G(s), from V_{Ty} to V_{thy}. (Col. 4, lines 25-29)

The '601 Patent does not teach or suggest a digital rebalance controller circuit as presently claimed. "Computed transfer functions, G(s), from V_{Ty} to V_{thy}," indicates that the transfer functions which the control circuit implements are developed by computation or measurement, not that the circuit itself "computes".

Further, the Office Action asserts that the '601 Patent teaches a digital demodulator for demodulating the sense rebalance signal with the drive mode response signal to produce a digital rate estimate of the vibratory gyroscope in claims at column 4, lines 29-30. However, here the '601 Patent teaches "the reference signal used to demodulate V_{Ty} is V_{Tx} which is in phase with the drive axis signal, Θ_x." The '601 Patent does not teach or suggest a digital demodulator as presently claimed.

Thus, Applicants submit that nowhere does the '601 Patent teach or suggest a digital drive controller circuit, a digital rebalance controller circuit, a digital demodulator and a distributed digital control circuit as presently claimed. Accordingly, Applicants respectfully submit that because each and every element of the claimed invention is not taught or suggested by the cited reference, the '601 Patent, the rejection under 35 U.S.C. §102(b) is overcome and independent claims 1 and 16 allowable over the '601 Patent. Similarly, dependent claims 2-15 and 17-30 are allowable of the '601 Patent in the same manner because they recite all the limitations of the independent claims. In addition dependent claims 2-15 and 17-30 recite further novel elements not taught the '601 Patent.

VII. Conclusion

In view of the foregoing, it is submitted that this application is now in good order for allowance and such allowance is respectfully solicited. Should the Examiner believe minor matters still remain that can be resolved in a telephone interview, the Examiner is urged to call Applicants' undersigned attorney.

Respectfully submitted,

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